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Virtual Visits in Prenatal Care: An Integrative Review

Introduction

HealthyPeople2020 has identified that, as of 2016, only 75.6% of women received early and adequate prenatal care in the United States, defined as care initiation in the first trimester and completion of at least 80% of the recommended visits according to the Adequacy of Prenatal Care Utilization Index.¹ This is problematic given rising rates of maternal and neonatal morbidity and mortality.² Prenatal care supports healthy pregnancies through education like nutrition and exercise counseling, while also enabling prompt diagnosis and intervention for conditions that could significantly affect fetal growth and safe birth, such as sexually transmitted infections, gestational diabetes, and hypertensive disorders.^{3,4} Access to care has been identified as one of the factors influencing prenatal care usage and comprises issues related to transportation, conflicts with employment hours, scheduling appointments, and a lack of local perinatal services.^{4-6,7} This is especially a concern in rural communities that continue to experience clinic and hospital closures, as over 50% of women in rural areas travel more than 30 minutes to seek obstetric care, and 10% travel more than 100 miles.^{5,8,9} Furthermore, this gap in access to care has been accentuated in black and Hispanic communities, where a higher percentage of rural clinic closures have occurred, exacerbating the disparities seen in birth outcomes for both rural and ethnic minority women.^{5,9}

Telemedicine has shown significant promise in effectively addressing gaps in health care access across many health disciplines, and so its use in prenatal care specifically is worth investigating as a potential intervention to improve women's access to adequate prenatal care in the United States.¹⁰ In addition, the onset of the COVID-19 pandemic has resulted in widespread adoption of telemedicine practices and the passing of policies that decrease barriers to its use. Thus now is an especially opportune time to consider how telemedicine can most appropriately be implemented in the antepartum setting to address disparities in access that are not affected by the digital divide.¹¹

The purpose of this integrative review is to gain a deeper understanding of how virtual visits have been integrated alongside in-person visits during routine prenatal care and what the experience of this has been for patients and providers. The three-part question formally guiding the review was as follows: *In exploring the use of virtual visits in prenatal care, what has been the experience of patients and providers, what facilitators and barriers have been identified during implementation, and what essential content has been incorporated in virtual visits for routine prenatal care?* The synthesis of these findings offers obstetric providers insights into evidence-based application of virtual visits in prenatal care and identifies gaps where future research is needed.

Theoretical Framework

The Social Ecological Model served as an organizing framework for answering these broad-ranging questions.¹² This model enables health interventions, such as the implementation and use of telemedicine, to be evaluated from a wider perspective that considers individual factors and then moves outward to account for the greater environmental context where people

live and experience care.¹² Review findings for the research question were thus categorized into the five factors identified within the model:

- 1) **Individual factors** encompass individuals' past experiences, personal characteristics, diagnoses, skills etc. that may influence their experience of telehealth. Examples of individual factors include their comfort level with technology, as well as provider and patient preferences and experiences with telehealth.
- 2) **Interpersonal processes** incorporate any formal or informal relationships. An example of an interpersonal process would be the ability to form trusting provider-patient relationships during a telehealth visit.
- 3) **Organizational factors** consider the environment and policies within institutions as a whole. This would include specific prenatal virtual visit schedules or models shared by institutions. Examples of organizational factors include the process a clinic uses for scheduling telehealth visits or the virtual platforms utilized while conducting the visits.
- 4) **Community factors** reflect the wider social systems beyond an organization, including professional organizations. For example, one community factor to consider in telehealth would be access to a secure internet connection in more rural or isolated communities.
- 5) **Public policy** includes the local, state, or national policies that impact the ability to provide or receive care. For example, policy may affect insurance reimbursement or the ability to virtually see providers across state lines.

Methods

The literature search methodology put forth by Whitemore and Knafl (2005) served as the guiding framework for this integrative review.¹³ Their approach outlines a systematic process for conducting a transparent and reproducible literature search. This method allows for the flexible inclusion of diverse literature including study methodologies and designs to create holistic insight into the phenomenon of interest.¹³ The database searches, record screening, and literature analysis were all conducted by the primary author with periodic consultation with a reference librarian and senior investigators.

A Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow diagram depicts the search process for article selection (see Figure I).¹⁴ Following consultation with a reference librarian to develop a search strategy, the database searches were conducted in September, 2020, utilizing Medical Subject Headings (MeSH terms) and the Boolean operators AND/OR with the following search terms: *telemedicine, telehealth, telecare, virtual visits, mhealth, m-health, mobile health, ehealth, e-health, antenatal, antepartum, prenatal, pregnancy, antenatal care, prenatal care, obstetric care, maternity care, perinatal, obstetrics, maternity, maternal, maternal health*. As the nature of telemedicine changes rapidly, the search was limited to articles published after 2010. Electronic publications available ahead of print were included. This search was conducted using the following databases: PubMed (n = 1767), CINAHL (n = 741), SCOPUS (n = 1680), and Google Scholar (n = 75), and search results were all imported into Covidence¹⁵ for review management. This initial search yielded 2,666 articles after duplicates (n = 1,597) were removed.

Titles and abstracts were screened utilizing pre-established inclusion and exclusion criteria. Inclusion criteria specified publications must be either original studies or quality improvement projects, and they needed to address virtual, synchronous visits, such as those conducted through phone calls or video web-conferencing. These visits needed to be between pregnant patients and their healthcare providers, such as nurses, advanced practice nurses, or physicians. While the primary focus of this review was on routine prenatal care, articles addressing management of gestational diabetes, hypertensive disorders in pregnancy, and maternal fetal medicine consults were also included. In contrast, publications were excluded if the purpose of the virtual visit was not focused on care specific to pregnancy, such as in the management of symptoms related to COVID-19 or perinatal depression. Articles focused primarily on abortion care, tele-ultrasound, genetic counseling, and remote telemonitoring were also excluded unless the home monitoring specifically outlined a virtual visit component to the care regimen. Articles focused on mobile applications were also excluded unless the purpose of the application was to facilitate scheduled visits with obstetric providers. Grey literature and reviews were excluded in addition to any articles not available in English. The reference lists of all applicable reviews were screened using the same inclusion and exclusion criteria, and this did not yield any additional studies. A hand search from 2015 to present with the following journals also did not contribute any additional articles: *Journal of Midwifery and Women's Health*, *American Journal of Obstetrics and Gynecology*, *Obstetrics and Gynecology*, *Journal of Telemedicine and Telecare*. Following this initial screen of 2,666 publications, 2,505 articles were excluded, leaving 161 articles for full-text review, of which 12 original studies and one quality improvement project met all criteria to be included in this review. A literature review matrix was created to summarize the 13 included publications (see Table I).

Results

The articles were all published between 2013 and 2020, with five of the 13 published in 2020 and pertaining to implementing a virtual care model out of necessity during the COVID-19 pandemic.¹⁷⁻²¹ Eleven articles took place across the United States,^{16-19, 21-27} one was in Poland,²⁸ and one in Japan.²⁰ There were diverse methodologies and designs, including observational studies,¹⁹⁻²³ qualitative description,²⁴ a qualitative analysis of a larger randomized controlled trial,²⁵ mixed methods,²⁶ cross-sectional studies,¹⁷⁻¹⁸ prospective cohort,^{16, 28} and a randomized controlled trial.²⁷ Eight publications focused on either low risk pregnancies or did not distinguish risk levels,^{16-17, 19-20, 23, 25, 27-28} while five studies examined telehealth specifically in high-risk pregnancies.^{21-22, 24-26} Collectively, data was obtained from 96 obstetric health care providers and 14,787 pregnant women. Half of pregnant women in samples were predominantly White, and there were a variety of geographical settings ranging from densely populated urban to rural communities.

Of the four studies that specifically compared health outcomes between in-person and virtual visit care models in both low and high-risk populations, all ultimately concluded that there was not a significant difference in outcomes.^{16, 20, 22, 27} Examples of measured outcomes included unplanned urgent care visits or hospitalizations, decision to vaccinate in pregnancy, cesarean birth rates, preterm birth rates, and newborn birth weights.^{16, 20, 22, 27} They all concluded that offering virtual visits could reasonably be integrated without impacting safety for pregnant women or their fetuses.^{16, 20, 22, 27}

The following findings have been organized according to the five factors of the social ecological model: individual factors, interpersonal processes, organizational factors, community factors, and public policy.¹²

Individual Factors

Individual factors impacting virtual prenatal care that were identified in these studies included the demographics of those opting to use virtual care, factors associated with individual patient satisfaction and barriers, and factors associated with provider satisfaction and barriers. In studies that gave women the choice of using the traditional model of prenatal care with exclusively in-person visits vs. incorporating virtual visits alongside in-person visits, women choosing virtual visits were more likely to be younger (<30 years old),^{22, 28} White,²² married,¹⁶ and be multiparous (seven-fold).^{16, 23} Study findings were conflicting on if those utilizing public health insurance were more or less likely to use telehealth services.^{16, 22} One practice offered 1,058 low-risk women the choice for their care model, and 11% opted for the integrated virtual visit track.¹⁶ Of those who chose the traditional, in-person model, 72% reported they wanted to see their provider at every visit.¹⁶

Patient satisfaction and confidence in the care provided was consistently rated high, as reported through interviews and surveys covering domains like ease of scheduling, technology, provider interactions, and personal benefits.^{17-18, 21-22, 24, 26-27} Patients appreciated the time and cost savings associated with not needing to take time off work, find childcare, or arrange for transportation, and this was consistent in both rural and urban settings.^{17, 22, 24, 26} One study in a rural community calculated a \$90 per visit in patient savings associated with each maternal-fetal medicine virtual consult.²² In a study that designed a care model where nurses conducted the virtual visits, they noted a decrease in prenatal stress levels in the virtual care group, possibly attributable to a greater focus on connection during virtual visits and an increase in visits overall for pregnancy.²⁷ Some women expressed appreciation for cultivating their own self-management skills, as models typically had patients entering exam findings into their electronic medical records.^{25, 26} A patient preference was not conclusive for conducting audio-only vs. audio-video virtual visits, with one study reporting a 50/50 preference among women.²⁶ 74% of women in an urban setting during the pandemic reported they would like a mix of both in-person visits and telehealth in the future.¹⁸

Patients generally needed to be familiar with technology, have access to a device like a phone or laptop, and have access to an internet connection or data to participate in care virtually.^{19, 26} While most reported general ease with technology, anxiety with technology and virtual platform difficulties were the most commonly cited patient barriers to utilizing virtual visits.^{22, 25} Some models had an associated patient cost increase with virtual care, such as needing to purchase software for video-conferencing or pay additional shipping costs for the clinic to mail out equipment like a blood pressure cuff.^{16, 20}

Provider satisfaction was also consistently high across studies, with the vast majority believing it was increasing access to quality prenatal care for both low and high risk patients.^{18-19, 25} Changes in provider workflow efficiency with telehealth were inconclusive across participants, though more commonly productivity was negatively impacted in the initial transition to offering

virtual visits.^{19, 21, 25} In a study implementing telehealth during the COVID-19 pandemic, providers' interest in using telehealth long-term rose from 45% pre-pandemic to 89% during the study.¹⁹ In a model utilizing nurses to conduct virtual visits with low-risk patients, physicians reported appreciating that it enabled them to focus more time on their high-risk patients, and nurses in this study enjoyed working to an increased scope of practice.²⁵ The majority of providers found the technology easy to launch, though there were conflicting reports on if they had adequate technology support during the transition.¹⁹ Only 6% of providers in one study reported having significant challenges.¹⁹ Lastly, one study during the pandemic enabled providers to conduct virtual visits from their own homes.²¹ These providers felt they were able to deliver more focus during the visit without the distractions of clinic operations, and they also appreciated having more personal time due to not having to commute.²¹

Interpersonal Processes

Few studies specifically explored the patient-provider relationship in-depth, though satisfaction survey items asking about provider interactions and attentiveness did score favorably.²²⁻²³ Pregnant women noted a clear preference for having a consistent provider for virtual visits, believing it affected their continuity of care.²⁵⁻²⁶ In the study that created a model where nurses conducted the virtual visits instead of the providers, both nurses and patients reported a higher level of connectedness.²⁵ However, some of these patients reported desiring more of an opportunity to connect with their potential birth providers.²⁵ While not noted by the physicians in this practice, this concern for birth provider connection was shared by the certified nurse-midwives in the practice who cited the importance of establishing patient-provider relationships in a midwifery model of care.²⁵ While some patients said the virtual visits felt like a regular face-to-face conversation, others felt uneasy with multiple people potentially watching.²⁴ Some participants using audio-only telephone visits wished they could see providers' reactions to their test results and reported they perceived less time to ask questions.²⁶ In a descriptive qualitative study exploring the use of telehealth to deliver poor pregnancy prognoses, women reported sensing less compassion and empathy than they would have expected in-person, though other women did report it felt comparable to in-person encounters.²⁴ Two studies discovered that the potential for family inclusion and support during visits is generally higher in a telehealth context.^{22, 24}

The relationship dynamics among coworkers also shifts when integrating a new telehealth program, particularly with rapid implementation during the COVID-19 pandemic.^{19, 21} The addition of new staff for facilitating and supervising a telehealth transition and the need to navigate departmental, ancillary staff, and IT support personnel becomes especially important for receiving timely assistance with new protocols and technology use.¹⁹ Having provider colleagues with telehealth experience was regarded as a facilitator that helped providers navigate the high technology learning curve during an initial telehealth transition.¹⁹

Organizational Factors

These studies included many examples of the organizational factors and effects of implementing and practicing telehealth in prenatal care, including changes to clinic flow, general

considerations in transitioning a practice to telehealth, models for when to schedule virtual vs. in-person visits, and the key elements chose to include during routine prenatal visits.

Changes to clinic and visit flow.

Many practices noticed a change in clinic and visit flow upon incorporating virtual visits. Clinic wait times decreased and there were fewer no-show and cancellation rates for scheduled virtual visits in three of the studies,^{17-18, 21} with no difference noted in one study.¹⁹ Visits tended to take less time, and documentation was also more time efficient.^{16, 19} While one practice noted a distinct drop in total visits and a higher percentage of acute care visits upon implementing telehealth, this was likely due to attempting to only schedule the most essential visits because of the COVID-19 pandemic.²¹

Transition to telehealth.

Anticipatory preparation for the change to telehealth was an important step for smooth delivery of care. The additional task-reassigning of staff assignments to oversee telehealth implementation and provide technical and ancillary support was considered, depending on the size of the organization.^{20, 19, 21} Providers received training on differences in billing and coding and how to use the new technology.^{17, 19, 21} Having pre-established consensus on protocols for patient inclusion criteria to opt for virtual visits and an established visit schedule timeline for when patients could do virtual visits instead of in-person visits facilitated a clear process and communication among both providers and patients.^{16, 19} Patients also required education on the proposed schedule, how to use the selected technology, and how to use the medical equipment needed for home assessments.^{24, 26} Some patients reported they would have appreciated more preparation for how to use the technology, making this education another important step.^{24, 26} As scheduling issues were identified as a barrier to streamlined care, having a process, such as verifying date, time, and patient phone number to be reached, was an important planning step.^{17, 19} Consistency in documentation facilitated insurance reimbursement, with recommendations for including the starting and ending times for the visit, patient identity confirmation, and verbal consents to treat.^{17, 19, 21} Decisions had to be made on what type of technology to include. These publications utilized phones, handheld devices, and computers, with audio only and audio-video options.¹⁶⁻²⁸ Simply purchasing several cameras and additional iPads, made the transition notably cost effective for some practices.²¹ Some studies simply used a phone for an audio call, while others had integrated electronic medical record platforms that enabled patients to enter their physical exam findings directly into their patient charts.^{17, 26} Arranging for translation services improved access and ensured compliance,¹⁷ though one study noted this service was cumbersome in the virtual environment.¹⁹

Schedule for routine prenatal care.

Proposed schedules varied among the five studies that presented a timeline, ranging from having 5-9 in-person visits and 4-6 virtual visits.^{16-18, 20, 27} A study with high-risk patients saw women in-person at least every 6 weeks, with virtual visits every 1-3 weeks.¹⁸ Two publications presented comprehensive appointment schedules: the OB Nest model trialed using a small team

of nurses to conduct their virtual visits (see table 3),²⁵ and the OB Care Connect™ model utilized nurse practitioners for their virtual visits (see table 4).¹⁶

Key components for routine prenatal care virtual visits.

Seven articles relayed the key exam components they included during the routine prenatal care visits conducted virtually. All of them had patients report their weight and blood pressure.^{16, 18, 20, 23, 25-27} Fetal heart tones were assessed in all studies except one,²² typically by auscultation during the virtual visit, with the pregnant woman using a fetal Doppler and the provider listening remotely.^{16, 18, 23, 25-27} Instead of using a fetal Doppler, a practice in Japan chose to ship cardiocograms to patients during the COVID-19 pandemic, who would then conduct a 20 minute tracing prior to each of their virtual visits up to 26 weeks, after which time they did not include fetal heart rate in the virtual assessments.²⁰ The study that did not assess fetal heart tones was conducted in a high risk obstetric population during the COVID-19 pandemic, and they reported continuing to see patients in-person at least every 6 weeks.²² Fetal Dopplers and blood pressure cuffs were provided to patients by the clinic, at no cost apart from the shipping costs associated with the study in Japan.^{16, 20, 25, 27}

The timing for lab testing and ultrasounds was unchanged and conducted during in-person visits.¹⁷ Fundal heights were not measured or recorded in any of these practices during virtual visits.^{16, 18, 20, 23, 25-27} While the total number of visits, including both in-person and virtual visits, remained unchanged or slightly increased with the addition of virtual visits, planned prenatal education, counseling, and screenings that had flexible delivery timing were typically conducted during the virtual visits.¹⁶

Community Factors and Public Policy

The final two levels of the social ecological model, community factors and public policy, were minimally addressed, and thus will be discussed jointly. Telehealth was consistently concluded to bridge the gap to accessing prenatal care at the community level, notably in low-income and low resource areas, in both urban and rural communities, and during times requiring swift change such as with the COVID-19 pandemic.^{17-19, 20, 22, 26} It can also assist in improving access to care during travel or when language barriers are of concern.^{16, 28} One consideration offered for low-resource settings is to use audio-only visits by telephone if members of a community may not have consistent access to data or a secure internet connection.¹⁷

Finally, the study that took place in Japan during the COVID-19 pandemic addressed how the hospital system, the city's government, and the ministry of health all swiftly approved the use of telehealth in prenatal care, enabling the hospital to rapidly implement a virtual care model.²⁰ Similarly, the Centers for Medicare and Medicaid Services relaxed regulations in order to expand telehealth coverage during the COVID-19 pandemic through the Coronavirus Preparedness and Response Supplemental Appropriations Act, enabling reimbursement for services like audio-only visits.¹⁷⁻¹⁸ Emergency measures to ensure equivocal reimbursement for comparable telehealth services has both protected access to care and maintained a consistent revenue stream for obstetric practices.¹⁷ While one study reported telehealth especially helped bridge access gaps for those with public insurance,²² another study reported their patients with

Medicaid faced additional barriers to telehealth services not seen in their patients with commercial insurance.¹⁹ A need was identified for the ongoing expansion of state and national policies to support innovative practice models in telehealth and to support the scope of health expansion for medical professionals to engage in telehealth.²⁵

Discussion

This review is unique in the literature as it is the first to explore synchronous, virtual visits in prenatal care. To date, reviews on telehealth in prenatal care have primarily focused on phone applications in pregnancy, remote telemonitoring, or ways to manage conditions like gestational diabetes using primarily asynchronous telehealth methods.²⁸⁻³² The application of the social ecological model¹² aided in organizing this subcategory of telehealth in a distinct and novel way in the literature to create a more holistic understanding of the state of the science.

The first guiding question, which sought to capture the experience of both patients and providers, primarily identified individual and interpersonal level factors of the social ecological model. There was a consistent, strong satisfaction experience among patients and providers, encompassing convenience, well-functioning technology, provider interactions, and confidence in the care provided. One study even demonstrated lower rates of stress in women utilizing virtual visits for routine care compared with those who only had in-person visits,²⁷ suggesting the possibility for enhanced clinical benefits with virtual care. These high levels of satisfaction are important because previous research demonstrated that even though reducing in-person visits for routine prenatal care did not affect health outcomes,³³⁻³⁶ patient satisfaction could be reduced.³⁷⁻³⁸ Findings from this review suggest that virtual visits may be a way to maintain patient satisfaction even when in-person visits are reduced.

Additionally, virtual visits were conducive to patients' lifestyles, saving patients both time and costs related to transportation, missed work, and childcare. Virtual visits may have helped contribute to fewer cancellations and lower no-show rates, with clinics often experiencing shorter wait times as well. This suggests an overall improvement in prenatal care access, despite none of the studies specifically measuring care access as a study outcome. Given that the literature on no-show rates in telehealth vs. in-person visits is inconclusive outside of this review³⁹⁻⁴¹ and prioritizing essential visits during the COVID-19 pandemic may inadvertently skew studies assessing telehealth attendance during the pandemic, findings from this review suggests that improved rates of attendance at virtual visits merits further investigation. Reminder calls and texts did improve visit attendance.¹⁹ Virtual visits appear to appeal to younger (<30 years old), partnered, White, and multiparous women. The data on multiparous women was especially strong, and may reflect these women having fewer concerns to discuss with their providers or simply a greater level of inconvenience to arrange for childcare or bring their children to attend an in-person visit. As the only studies reporting on those selecting virtual care had predominantly White populations, more research among diverse pregnant populations on the acceptability of virtual care is needed, especially as it may relate to increasing access and engagement of traditionally under-resourced populations.

Providers' experience using telehealth was also very positive, and while there was not consensus on a preference for virtual versus for in-person visits, many were interested in using telehealth more in the future. There were varying responses on the impact virtual visits had on provider efficiency, though transitioning to a new model of care can take time for initial adjustment and improved systems. Consistent with this review's findings, another review examining provider satisfaction with telehealth found that their satisfaction was closely associated with their ability to provide input into the development of a telehealth program and have reliable technology and support.⁴² These results highlight the importance of provider engagement during initial stages of implementation.

While negative patient and provider experiences were less common, they were typically a result of discomfort with technology, insufficient training on the technology, or technology that malfunctioned.^{19, 22, 25-26} Participants in one study expressed concern regarding the ability for providers to display empathy virtually,²⁴ while patients and midwives in another study were apprehensive about the lack of time to develop relationships with providers if birth providers were not the ones conducting the virtual visits.²⁵ None of the studies explicitly explored how telehealth affects the patient-provider relationship, perception of support, or trust establishment, all of which are important for birth preparation.⁴³ Subsequent studies are needed to investigate how telehealth may help augment these supportive aspects of the patient-provider relationship.

This review also sought to understand known facilitators and barriers to implementing a telehealth model of care. Facilitators to telehealth implementation were primarily identified at the organizational factors level of the social ecological model. They included having well-designed training modules for both patients and providers to learn the new technology as well as a clear process for implementation.^{19, 25-26} Both providers and patients benefited from having established guidelines and protocols to determine what patients and conditions would be eligible for virtual care.^{19, 25} Consistent documentation expectations among providers, including verbal consents to treat, timeframe of the visit, and billing charges, also facilitated a smooth transition to virtual care.^{17, 19, 25} As few studies^{17, 19, 21} explored the organizational process including the impact of telehealth on practices, this is an area that requires more research. Similarly, as very few studies explored the role of insurance in outcomes and none specifically investigated the policy level of the social ecological model, there remains a gap in understanding how policy affects access to and reimbursement for virtual visits conducted during prenatal care. As policy and insurance reimbursement concerns have historically been significant barriers, the COVID-19 pandemic has created numerous pathways for telehealth expansion that are likely to change the trajectory of telehealth well beyond the pandemic.^{17-20, 25}

Finally, this review sought to glean information on which exam components were being maintained during routine prenatal care visits conducted virtually. The articles addressing routine care all consistently incorporated blood pressure and maternal weight,^{16, 18, 20, 23, 25-27} with all but one²² including a fetal heart rate and none of them attempting to obtain a fundal height. Counseling and education topics continued in a traditional prenatal visit schedule, though some intentionally chose to put more of the education topics with flexible delivery timing on the visits conducted virtually.¹⁶ Given that the World Health Organization recommends that only eight

visits are needed to deliver adequate prenatal care, it was noteworthy that none of the studies exploring innovative models with virtual visits attempted to reduce the total number of visits patients received, typically 12-14 in the United States.⁴⁴ Because schedules with fewer visits have been found to be sufficient to deliver comparable safety outcomes,³³⁻³⁶ it would also be reasonable to explore patient and provider satisfaction with fewer exam components during virtual visits in future research.

Limitations

The primary limitation to this review was that only one investigator conducted the search, applied inclusion and exclusion criteria, and reviewed articles meeting criteria. This lack of multiple reviewers can introduce bias, possible errors, and inconsistency in the application of search criteria.⁴⁵ By following the integrative review framework put forth by Whitemore and Knafl,¹³ utilizing the PRISMA flow chart, and periodically consulting a reference librarian and other investigators, the primary author took steps to improve rigor and transparency.

While this review attempted to locate all available research and quality improvement projects on prenatal care and virtual visits, there may be other studies in telemedicine, though not specific to prenatal care, that could provide more holistic answers to this review's research questions within the social ecological framework. Similarly, a significant amount of grey literature, such as commentaries, has recently been published on telemedicine in obstetrics in light of the COVID-19 pandemic. While outside the scope of this review, these documents could provide more insight into potential policy and implementation questions and should be explored in the future.

Conclusion

This integrative review followed a transparent search process to identify original research studies and quality improvement projects pertaining to the use of virtual visits in prenatal care to assess the patient and provider experience, identify barriers and facilitators to telehealth implementation, and determine what standard elements have been included during routine prenatal visits conducted virtually. The 13 articles included in this analysis were published between 2013 and 2020 and are representative of varied research methodologies, including one quality improvement project. The results of this review support safety equivalence in birth outcomes between providing models that combined virtual visits with in-person visits when compared to a traditional model of exclusively in-person visits in both low and high risk prenatal populations. There were consistently excellent patient and provider satisfaction ratings. Virtual visits provided time and cost savings to patients and reduced appointment cancellations and no-show rates. For successful implementation, adequate technology training and support for both patients and providers was key, along with clear guidelines for what patients and conditions would qualify for virtual care. All studies conducting routine prenatal care virtually incorporated blood pressure and maternal weight, and fetal heart tones were also typically recorded during virtual visits. The preliminary safety and high user satisfaction findings in this review highlight the potential for the inclusion of integrated virtual visit models in prenatal care as a trailblazing resource to improve access to maternity care in the United States.

Figure I. PRISMA Flow Chart

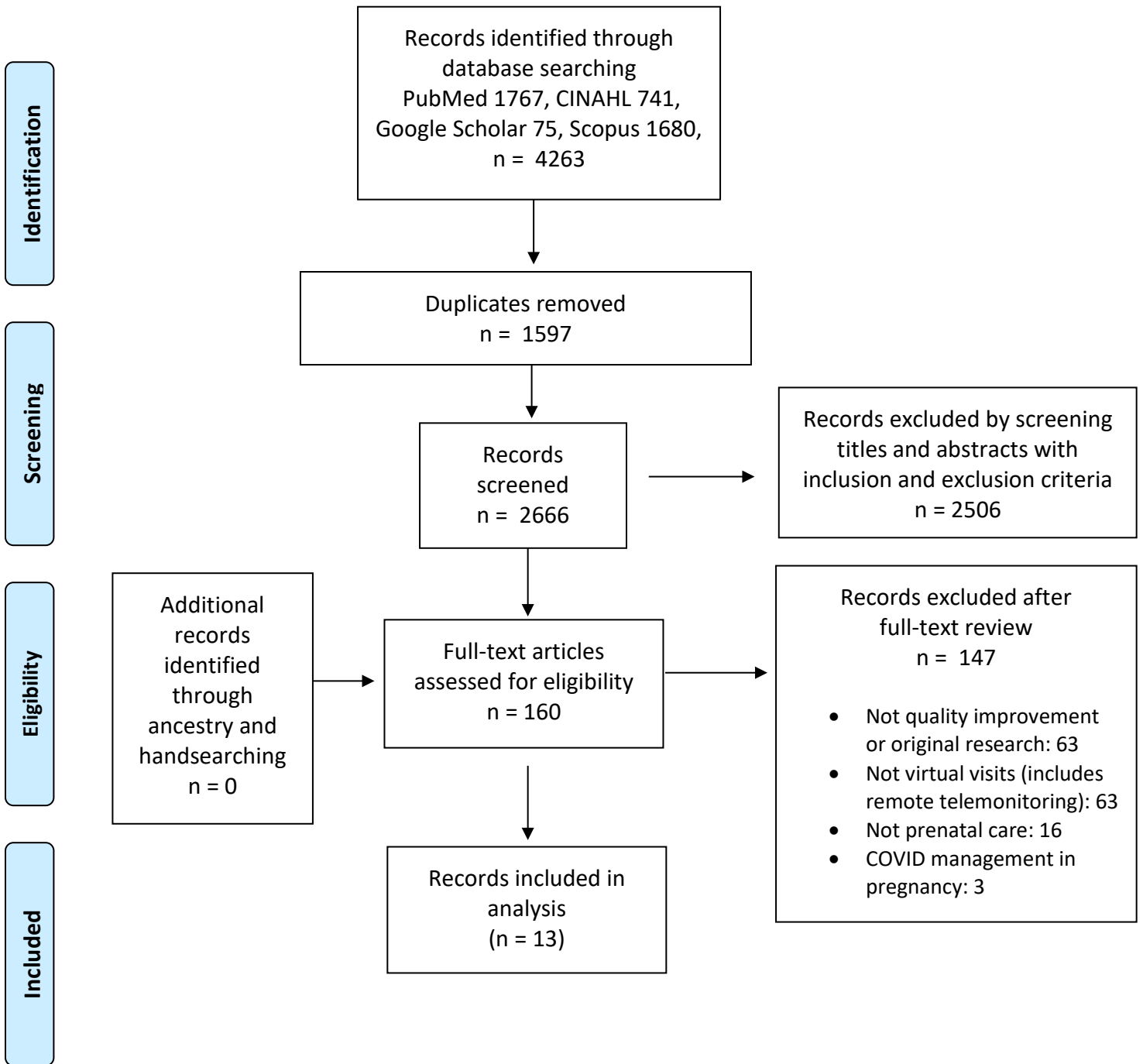


Table 1. Literature Matrix

Author Date	Aim	Sample/Location	Study Design Data Collection	SEM Factor s	Key Results
Baron et al. 2018 ²⁵	To explore the perspectives of patients, nurses, and providers on the use of a care model 'OB Nest' that uses virtual prenatal visits with nurses and home monitoring devices for low-risk pregnancies	41 low-risk, predominantly White pregnant women 10 registered nurses 8 physicians 9 certified nurse-midwives (CNMs) Minnesota, United States	Qualitative secondary analysis of a larger randomized controlled trial Individual interviews and online focus groups	I, II, II, V	Virtual visits with nurses intervention: - fewer in-person visits - greater satisfaction Nurses valued relationships with patients and working to a greater scope of practice. Physicians valued being able to focus on higher risk patients. CNMs expressed concern over less visit time to build patient relationships. Providers expressed need for more protocols to ensure patient safety.
Butler Tobah 2019 ²⁷	To assess the acceptability and effectiveness of the prenatal care model 'OB Nest' that uses virtual prenatal visits with nurses and home	300 low-risk, predominantly White pregnant women Minnesota, United States	Randomized controlled trial Patient surveys Electronic Medical Record data	I, II, III	Virtual visits with nurses intervention: - fewer in-person visits (~2.8 less) - greater care satisfaction - lower stress related to pregnancy Increased nursing coordination time

	monitoring devices for low-risk pregnancies				No differences in maternal or fetal outcomes, with the exception of a higher incidence of gestational diabetes with virtual visits.
Harrison et al. 2017 ²⁶	To assess the acceptability of a telemedicine model for managing gestational diabetes that included alternating virtual visits with in-person visits	80 racially diverse pregnant women with gestational diabetes (70 completed surveys, 10 completed interviews) California, United States	Mixed methods, explanatory design Open-ended response surveys, in-depth interviews	I, II, III, IV	Most patients were not concerned about maternal or fetal safety in between in-person visits, generally confident in the care they received. Perceived it was time-saving (time off work, vacation days, childcare). Improved self-management skills. Required having a smart phone and being 'tech savvy.' Desired more continuity of care with providers and more training in using the equipment. 50/50 in preference for telephone vs. videoconferencing visits.
Holcomb et al. 2020 ¹⁷	To evaluate patient satisfaction with incorporation of audio-only prenatal visits during the COVID-19 pandemic	283 indigenous pregnant women, predominantly low socioeconomic status Texas, United States	Cross-sectional design Telephone surveys Data from the electronic medical	I, III, IV, V	Majority preferred a combination of virtual and in-person visits 99% believed their needs had been met with virtual visits. Appreciated the ease in

			record on clinic wait times and attendance rates		transportation barriers <1% reported technical difficulties Clinic wait times decreased ($p < .01$). Phone visits were more likely to be completed as scheduled ($p < .01$).
Jeganathan et al. 2020 ¹⁸	To determine patient and provider perspectives towards telehealth in high-risk obstetrics and examine if telehealth affects visit attendance rates	91 high-risk, racially diverse pregnant women and 33 corresponding providers across four urban and suburban sites New York, United States	Cross-sectional design Self-administered surveys	I, III, IV, V	Telehealth in high-risk obstetrics: <ul style="list-style-type: none"> - Significantly lower no-show and cancellation rates - Good satisfaction rates for both patients (86.9%) and providers (87.9%) - Good perception of privacy - 84.7% of patients easily connected to their visits Providers preferred in-person visits more than patients (56% vs 23%)
Karwowski and Gaslorowska	To assess the use of telemedicine in obstetrics	185 Polish women (76% gynecologic, 24% prenatal)	Prospective cohort study	I, IV	Telemedicine can assist in barriers to care related to language.

2018 ²⁸	and gynecology among Polish women	Poland	Electronic medical record data		Most women were <30 y.o. Most women only utilized the telemedicine service once, typically for a problem oriented visit. Immediate referral for evaluation was only needed once (diagnosis of preterm labor). Common reasons for seeking obstetric telecare: threatened miscarriage, preterm labor, concerns about fetal development
Leighton et al. 2019 ²²	To assess the effect of maternal- fetal medicine (MFM) services delivered via telehealth on patient satisfaction and health outcomes	High-risk, predominantly White pregnant women, majority publicly insured, in primarily rural regions 465 completed patient surveys Data extraction from 6757 patients (6302 in-person, 455 virtual) Pennsylvania, United States	Observational study Patient surveys and electronic medical record data supplemente d with claims data	I, II, IV	MFM through telemedicine had comparable health outcomes. Patients saved an average of \$90.28 per MFM consult (travel and work) High level of patient satisfaction and confidence in care Patients choosing telehealth visits were more likely to be White, younger, and have public insurance

Madden et al. 2020 ¹⁹	To determine the degree to which telehealth was implemented in prenatal care during the COVID-19 pandemic and to identify resources and obstacles to this process	Pregnant women (4,248 visits) 36 obstetric providers New York, United States	Observational study with quantitative and qualitative methods Electronic health record data extraction Survey and semi-structured interviews with providers	I, II, III, IV	Telehealth was successfully rapidly implemented (over 1/2 by the 5 th week). Providers reported high level of satisfaction, convenient for both the practice and patients. Percentage of providers interested in using telehealth rose from 45% pre-pandemic to 89% during the study. Reported technology was easy to implement, but needed more support in the transition. Mixed reports on provider efficiency changes (42% reported improvement while 31% disagreed). Greatest barrier identified was patient difficulty with technology. Mild decrease in length of visits and time needed to document visits. Mixed reports on the effect on billing difficulties. Organizational facilitators: EMR that allows for records review and charting during visits, regular
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					telehealth progress meetings, continuous IT support for providers and staff
Nakagawa et al. 2020 ²⁰	To determine the safety of rapidly implementing telemedicine in prenatal care during the COVID-19 pandemic	44 pregnant women, 67 telemedicine visits. Hokkaido, Japan	Retrospective observational study Electronic medical record data	III, V	Only 1 of the 67 visits required immediate in-person follow up. Virtual visit outcomes were safe for both low and high-risk pregnant women. Reasonable to continue in light of pandemic.
Pflugeisen et al. 2016 ¹⁶	To evaluate a newly implemented model for routine prenatal care, "Care Connect," where virtual visits are integrated alongside in-person visits	1058 low-risk pregnant women (traditional care = 941, virtual care = 117) Washington, United States	Quality improvement conducted with a prospective cohort design Electronic medical record data	I, III	Those selecting virtual visits were more likely to be partnered (2x), be multiparous (7x), and less likely to be on government supplemental nutrition assistance Health outcomes were the same between the groups with the exception of a higher rate of preeclampsia in the virtual visits group (n = 10, p = .02)
Pflugeisen and Mou 2017 ²³	To compare patient satisfaction of those receiving traditional prenatal care vs. those	1173 low-risk pregnant women (traditional care = 795, virtual visits = 378)	Observational Satisfaction questionnaire	I, II, III	Satisfaction was significantly high in the virtual visits group (p < .01) Those selecting virtual visits were

	with integrated virtual visits	Washington, United States			more likely to be multiparous
Shields et al. 2020 ²¹	To compare traditional care vs. telehealth for maternal fetal medicine visits during the COVID-19 pandemic	High-risk, racially diverse pregnant women, 54 completed surveys (31 pre-telehealth, 23 telehealth) Texas, United States	Observational Patient satisfaction surveys Electronic medical record data	I, II, III	Transition initially negatively impacted provider productivity, but efficiency improved Decrease in scheduled visits following transition (53 vs. 40 visits/day, p < .01) Patient satisfaction was comparable before after telemedicine implementation. No show rate decreased
Wyatt et al. 2013 ²⁴	To evaluate patient satisfaction to hearing about poor pregnancy prognosis by telemedicine	8 predominantly White women in rural Arkansas, United States	Qualitative descriptive study Semi-structured interviews	I, II, III	Some reported sensing less compassion and empathy than they would have expected in-person, while others reported it felt comparable Easier inclusion of family support Patients valued the convenience, time and cost savings of not traveling Some would have appreciated more

preparation for
what to expect with
technology

Social Ecological Model (SEM) Factors:¹² I – Individual Factors, II – Interpersonal Processes, III – Organizational Factors, IV – Community Factors, V – Public Policy

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